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FIRST ALL-UNION CONFERENCE ON SOLAR ENERGY

The First All-Union Conference on Solar Energy was held in the Power Engineering Institute imeni G. M. Krzhizhanovskiy in Moscow [date not indicated]. Scientific workers from the power engineering institutes of the union republic Academies of Sciences, and representatives of ministries and interested departments participated in the conference.

Kirpichev's Report

The opening report on scientific problems relating to the field of solar energy was read by Academician M. V. Kirpichev. The speaker said that the special laboratory for solar energy, which was built recently at the Power Engineering Institute imeni Krzhizhanovskiy, must be the headquarters for this study.

After noting that the task of the conference was to unite and coordinate the work of helictechnicians in the Soviet Union, Kirpichev pointed out that Soviet heliotechnics had been in existence only about 20 years and was a very young branch of engineering science. Nevertheless, he said, even in this short time Soviet scientists had acquired considerable experience in making solar water heaters, solar driers, kitchens, hot-water boilers, solar refrigerators, special hothouses, steam generators, salt water distillers, special solar houses, reflectors for medical purposes, etc.

In the rest of his report Kirpichev made the following points:

In prerevolutionary Russia, utilization of solar energy for engineering purposes was little studied. The only experiments known were those of Professor Tserasskiy, who, in 1890, obtained high temperatures (up to 3,500°C) by means of a solar unit with a reflecting mirror.

Work on heliotechnics in the period following the October Revolution was begun by the late Professor B. P. Veynberg. He designed equipment for distilling, heating, and boiling water, for drying fruit, for research on the insulation of buildings, and for cooking food. He also built solar hothouses.

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He conducted theoretical and practical research on the use of solar equipment to produce steam, hot air, and mechanical energy and made accurate computations for solar units.

In 1926, V. N. Bukhman built a solar kitchen and, somewhat later, a special installation to treat the sick with reflected solar rays. At present, he is working on a solar heat accumulator for hothouses and orangeries during the winter.

Excellent practical work on the design and construction of solar water heaters, driers, and other equipment has been done by K. G. Trofimov. In 1936-41, the Leningrad Institute for Labor Protection of the All-Union Central Committee of Trade Unions was working to improve units for heating and boiling water by using solar energy and, in collaboration with the Leningrad Refrigeration Institute, on obtaining artificial cold by using solar refrigerating machines.

In 1941, the State Optical Institute was trying to develop solar steam boilers for distillers and kitchens. The solar units designed by B. V. Petukhov have given a good account of themselves in practice.

Along with the construction of new, cheap, productive solar water heaters and other equipment, Soviet scientists are working on large-scale heliotechnics to solve the problem of the industrial use of solar energy.

For some time, the Power Engineering Institute imeni Krzhizhanovskiy (F. F. Molero and others) has been engaged on the problem of producing steam for industry in solar units. The problem of increasing efficiency and obtaining uniform output was solved by increasing the concentration of solar rays, using a large mirror having the form of a paraboloid of revolution in which the theoretical intensity of solar radiation reached 6-8 million calories per square meter per hour.

In specially designed units, short operating tests were made in canning and ice manufacturing.

Experiments were also made in obtaining the high temperatures of superheated steam (up to 470°C) and in smelting metals. Like all new investigations, this experimental work was partially successful and partially a failure.

Our scientists are designing a solar paraboloid unit on the basis of past experience. This unit would need a fuel reserve for uniform operation, but it could also serve independently for seasonal work. The latter fact is particularly important inasmuch as there are areas of the economy in which the greatest demand for power occurs precisely when the influx of solar energy is maximum. These include refrigeration, irrigation, drainage of fields with steam pumps, water distillation, as well as certain branches of the food industry.

The construction of this enormous unit, whose design is based on concrete studies in heliotechnics, aerodynamics, and other fields, still requires a great deal of experimental and research work and preliminary solution of additional problems involved in the technology and economy of construction, circulation in the compact swinging boiler, wind forces, automatic control of the rotation mechanism, cleaning and maintenance of the mirror, etc.

Academician Kirpichev concluded his address by mentioning the problem of direct transformation of solar radiation into electrical energy and pointed out that positive results from this work would provide a key to the problem of solar energy utilization.

Molero's Report

F. F. Molero, Doctor of Technical Sciences, discussed "Problems in Utilizing Solar Energy," as follows

Although it is true that the most important problem in heliotechnics is the direct transformation of the sun's radiant energy into electrical or chemical energy, the only economically feasible method of using the sun's energy at present is by transforming it into heat energy (with a subsequent transformation into mechanical or chemical energy).

At present, solar units can be used to evaporate salt solutions to extract salts, to distill water, to raise the air temperature (hotbeds, driers, solar kitchens), to heat liquids (hot water for laundry and toilet needs, heating, etc.), to produce steam, to smelt metals and ores, to provide refrigeration, and to transform heat energy into mechanical or chemical energy. Mirrors must be used for the last four purposes.

The specifications imposed on these units are as follows: possibility of operation at any time of the year, high efficiency with uniform output, possibility of obtaining high temperatures with high efficiency, minimum unit cost without using scarce materials, ease of manufacture, simplicity of operation with minimum operating costs, durability, and simplicity of maintenance.

A great deal of work had already been done to solve all these problems. For example, a cheap method has been discovered to manufacture large, durable, and relatively light paraboloid reflectors; the principles underlying boiler self-circulation have been developed, a simple circulation system has been found for the boilers, production has been made more efficient, a kinematic system for the rotation mechanism has been devised which greatly simplifies boiler construction and provides reliable circulation in it, the problem of steam loads has been solved and definite results have been obtained toward automatic control of the unit. Solution of these engineering problems proved that use of solar energy to obtain steam of industrial parameters is feasible.

The heliotechnics laboratory organized in the Power Engineering Institute, Academy of Sciences USSR, and a special solar energy committee, composed of representatives of scientific institutes and consumer ministries, will cooperate in a systematic study of solar energy with the committee working on problems of management and coordination of all work in this field.

Veynberg's Report

A report on solar energy resources in the USSR was made by V. P. Veynberg, who stated that the USSR and its Middle Asiatic republics, especially, were in a favorable position in this respect. Only Arabia, Central Africa, and Central Australia receive comparable solar radiation, he said. In all other areas at the same latitudes (Greece, Italy, Spain, US, Japan, Korea, China, Argentina, Chile, and New Zealand), the amount of solar energy obtained at the earth's surface is less than in the USSR.

Veynberg stressed the need for intensifying the study of the transparency of the atmosphere, the persistence of various types of weather, the spectral composition of the radiation of the sun and sky, and the "black-body" temperature of the sky.

Zakharin's Report

A. G. Zakharin, Doctor of Technical Sciences, presented a report on the role of solar energy units in the electrification of agriculture.

He pointed out that investigation of the power resources of the European USSR revealed a steady decrease in water power and local fuel from north to south and from west to east He emphasized that the grain areas of the steppes have practically no cheap forms of power and that this makes imperative the wide utilization of solar energy in this region

Zakharin suggested that steam power and solar installations be combined to meet the needs of agriculture and that solar energy units, hydrostations, and wind stations be linked into more efficient systems of operation He maintained that research should be done on computations to define more exactly the percentage of total power which might be supplied by solar energy

According to Zakharin, an experimental unit should be set up in one of the steppe farm regions to solve technical and economic problems connected with the use of solar energy units

Other Reports

V N Bukhman spoke on the use of solar energy for medical purposes and on the storage of solar heat during the winter in hothouses and orangeries A report on his work in using solar energy in a certain type of "heat box" was given by A I Dedebulidze, Active Member, Academy of Sciences, Georgian SSR

A T Kochnev gave a talk on the development of heliotechnics work in Samarkand The main points of his address follow Theoretical research there has made possible estimates of the productivity of solar units from the optical constants characterizing the main elements of these installations A physical basis has been discovered for the construction and calculation of a solar distiller with ribbed surfaces The theoretical computations for the output of regenerative solar distiller with a ribbed surface have been made and the latter has been studied experimentally Calculations have also been made of the output of a stationary solar water heater with a horizontal boiler for a one-glass and a two-glass cover The calculations have been verified on experimental models of solar water heaters

B V Petukhov gave a long report on the possibility of using solar energy in the national economy with the help of low-potential solar energy units

Ye M Pankov discussed a trough-type pipeless solar water heater He stated that experimental research on the feasibility of heating water in a solar water heater without pipes and even without iron had produced positive results According to Pankov, this heater is easy to construct, requires no expensive iron tubing, and could be installed directly on the ground or on the flat roof of a building In planning such installations, the flat roof could serve as the bottom of the water heater. This water heater should be very useful in regions where solar radiation totals are high

V B Veynberg summarized the research work of the State Optical Institute on solar energy! The institute has built solar distilleries from its own calculations and designs. Tests have demonstrated that operation of these units would be profitable. Corrugated systems, consisting of sectional pressed glass elements, have been devised to serve as stationary solar distillers The institute has also manufactured productive stationary distillers using solar energy and fuel, and solar boilers operating at a temperature of 100°C. A steam boiler with a portable regenerative battery could be used as a portable distiller. A portable solar boiler with parabolic mirrors could be forced by means of fuel. The boiler could be used for heating water, cooking food, etc.

Veynberg also discussed computation methods for solar heating units

S N Shorin reported on the use of solar energy in heating buildings The idea of heating buildings by solar energy originated with the Russian physicist V A Mikhel'son, who drew up plans for this project in 1920. High temperatures are not needed to heat buildings In summer many buildings need artificial cooling Hence it would be very convenient to have air conditioning machines which would cool buildings in summer and heat them in winter.

L. M Rosenfel'd, Doctor of Technical Sciences, evaluated the possibilities of using solar energy for artificial cooling. S. G. Poyarkov outlined the structural design features of paraboloid units. G. I. Markov described the technological aspects of constructing paraboloidal solar energy units. N. Linitskiy gave a talk on solar units with horizontal mirrors.

The First All-Union Conference on Solar Energy showed that Soviet heliotechnics must be credited with many achievements vastly superior to the results obtained by foreign experts in this field.

The conference participants agreed that the operation of solar water heaters has passed the experimental stage and that the time was ripe for extensive introduction of them into the economy. At the same time, the development of such solar energy devices as steam and power units, refrigerating machines, units for heating and cooling buildings, driers, water heaters, distillers, boilers, kitchens, etc., should be continued. They recognized the need of setting up and developing work on the following problems of solar energy storage of solar energy in various forms, use of thermoelements and photocells; and utilization of solar energy furnaces and units for medical purposes. They stressed the need for collecting, systematizing, and publishing data on radiation balance and works on heliotechnics in the USSR. They recognized the extreme importance of technical and economic studies on the advantages of using various solar energy units in different branches of the economy.

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